JPL

Future Technology Directions

Global Positioning Systems (GPS)

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Communications, Tracking and Radar Division: Products

Precision GPS Technologies

Communications Architectures/Networks

- Spectrum Engineering
- Protocols, Coding & Data Compression
- Digital Signal Processing R&D
- Optical Communications

Flight & Ground Communications Systems

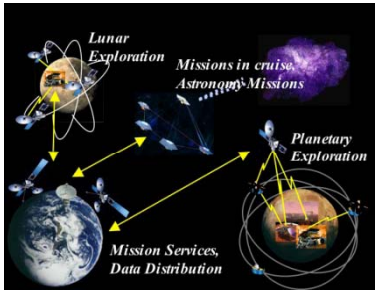
- Flight Transponders & Software Defined Radios
- Proximity/Relay Communications Systems
- RF Power Amplifiers & High Voltage Supplies
- Antenna RF & Microwave Engineering
- Antenna Mechanical & Structural Engineering
- Cyrogenic RF Electronics
- Exciters and High Power Transmitters
- Signal Processing Systems

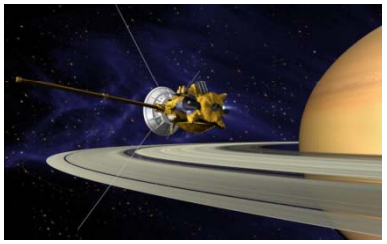
Flight Radar Systems

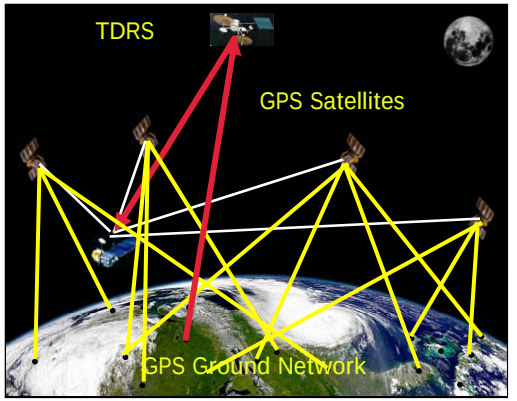
- Interferometric Synthetic Aperture Radars
- Altimeters, Sounders & Scatterometers
- Atmospheric Radars
- Descent & Landing Radars
- Ground Data Processing & Flight Radar Operations

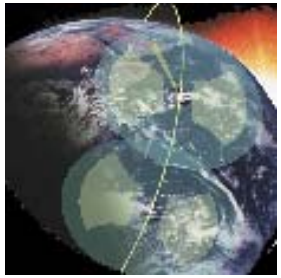
Tracking Systems

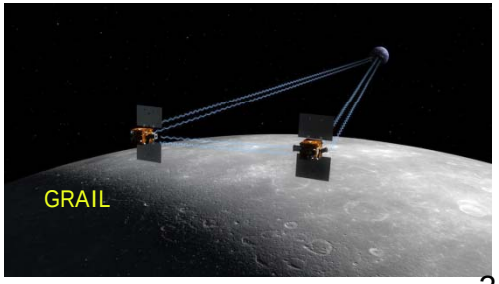
- GPS Ground Networks
- GPS Flight Receivers
- Real Time GPS Systems
- Formation Flying Sensors
- Precision Position & Gravity Sensors
- Frequency & Timing
- Ground Antenna Arraying, Correlators & Processors



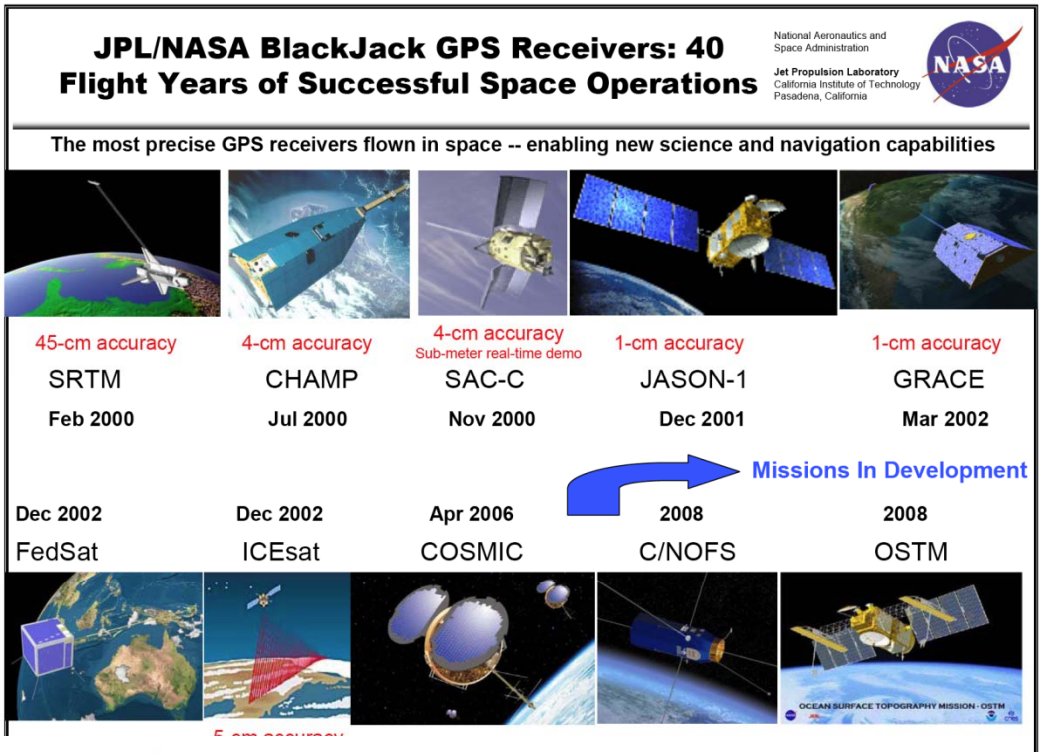




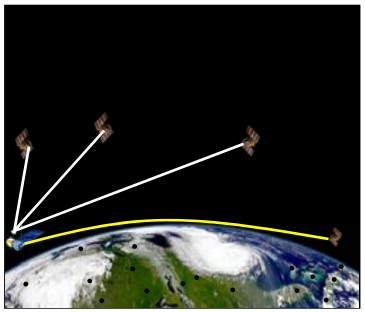




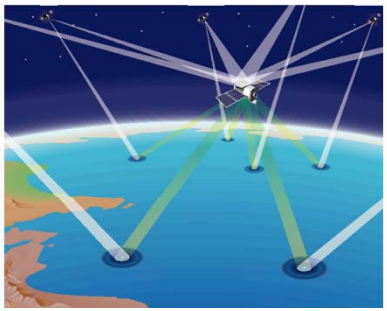
Advanced GPS Flight Applications: One of Many Areas Where We Partner with Industry



- **Most of these GPS flight instruments have been built by industry for JPL and other customers**
- **Our next generation flight GPS + Galileo flight instruments will have innovations such as ocean reflection capabilities**

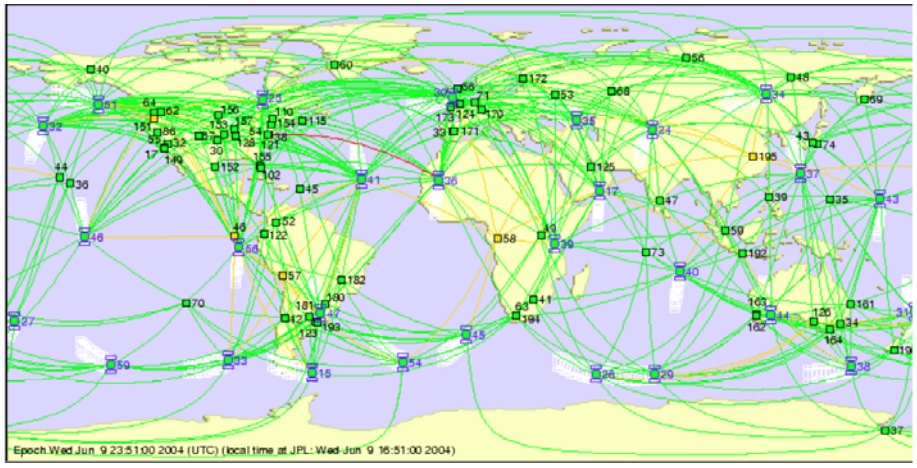


GPSRO (2011)

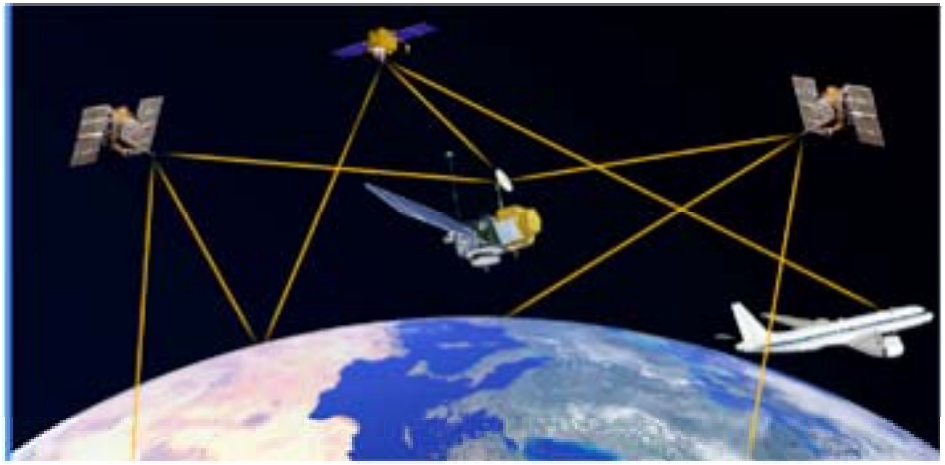


GPS Reflections (Ocean Altimetry)

Advanced Real-Time GPS Services



Real-time global GPS performance monitoring



Real-time Global Differential GPS

Real-time positioning for terrestrial, air and space users: 10-cm accuracy

Key system elements include:

- Ground network
- Network infrastructure
- Software
- Operations

JPL partners with industry in all of these areas

JPL and Industry Teaming
Communications, Tracking and Radar Division

- **Small Deep Space Transponder (SDST)**
- **Software Defined Radios for Space Flight**
- **Flight telecommunication equipment and components**
  - **Antennas, amplifiers (TWTA, SSPA), waveguides, waveguide transfer switches, isolators**
- **Optical Communications Technologies**
- **GPS ground networks and software**
- **GPS tracking applications**
- **GPS flight receivers**
- **Flight radars and radar technologies**
- **Wireless communications technologies**
- **Ground antennas (large apertures and antenna arrays)**
- **Military applications of communications, tracking, timing**
- **Antenna mechanical engineering**
- **Advanced Space Clocks**